

The Correlation between Working Period and Exercise Routines with Musculoskeletal Complaints on Batik Craftsmen

Nala Astari Pramesti, Shintia Yunita Arini

Department of Occupational Safety and Health, Faculty of Public Health, Universitas Airlangga, Indonesia
Campus C Mulyorejo, Surabaya, East Java, 60115 Indonesia

ABSTRACT

Introduction: Asosiasi untuk Demokrasi dan Kesejahteraan Sosial (Ademos) was founded as a form of anxiety towards rural communities whose majority of the population does not receive enough attention and access to economic development. One of the empowerment programs is a program to improve the quality of the Bojonegoro batik craftsmen. Workers can work more than 8 hours a day in a sitting and bending position for long periods of time. This study aimed to determine the correlation between the length of work and exercise routines on musculoskeletal complaints among batik craftsmen of Ademos, Bojonegoro Regency. **Methods:** This research was a descriptive analytic study using a cross-sectional design. The research was conducted in July-August 2020 on Ademos batik craftsmen in Bojonegoro Regency. The total population of the study was 42 batik craftsmen who were selected using a total sampling technique. The variables studied included tenure, exercise routines, and musculoskeletal complaints. Data collection was carried out through questionnaire sheets, observations and the Nordic Body Map Questionnaire. **Results:** The results of the study found that there was a significant correlation between working period and musculoskeletal complaints ($p=0.032$) experienced by Batik craftsmen of Ademos Bojonegoro. On the other hand, there was no correlation found between exercise routines and musculoskeletal complaints ($p=0.361$) on Batik craftsmen of Ademos Bojonegoro. **Conclusion:** The significant factor causing musculoskeletal complaints in Ademos Bojonegoro Batik craftsmen was the working period factor.

Keywords: age, batik craftsmen, exercise routines, musculoskeletal complaints, secure work

Corresponding Author:

Shintia Yunita Arini
E-mail: shintia.arini@fkm.unair.ac.id
Telephone: +6282233031117

INTRODUCTION

A human body is designed to perform all activities in daily work. The muscle mass in the human body accounts for nearly half of the bodyweight, which enables humans to do their job. However, if the muscle is subjected to static loads in the wrong position for a long time, it may cause discomfort in various parts of the skeletal muscle. Skeletal muscle discomfort is called as Musculoskeletal Disorders (MSDs) or musculoskeletal complaints regardless whether it is very mild or severe (Utami, Karimuna and Jufri, 2017).

Kahn and Line stated that the musculoskeletal gadget is a gadget that offers human beings the capacity to apply the skeletal system to move. The musculoskeletal system has a major role in providing shape, stability, and movement of the body (Viswanatha and Adiatmika, 2020).

Research on musculoskeletal complaints carried out within the scope of a business showed that the musculoskeletal complaints that are often felt by employees are complaints in the neck, shoulder, arm, hand, finger, back, waist, and lower muscless. Most of the musculoskeletal disorders do not cause disability, but can lead to disruption of work activities (Utami, Karimuna and Jufri, 2017). The impact of MSDs on production is a decrease in production and defects in the final materials, which ultimately leads to unsatisfactory production and service periods (Evadarianto and Dwiyantri, 2017).

Muscle work or physical effort is a type of contraction that occurs in body movements and limbs, where the mechanism depends on changes in the position of the musculoskeletal system (skeletal muscles), body movements, and limb movements. Besides, there are other body parts in the musculoskeletal system, such as nerves, blood vessels, ligaments, joints, and other structures. Therefore, these parts also play a role in the functioning of the musculoskeletal system according to its physiological function in musculoskeletal conditions. Any muscle contraction that is forced or

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that is used beyond its capacity has the potential to cause musculoskeletal trauma (Suma'mur, 2009).

Musculoskeletal complaints will get worse when the load on the muscles is too heavy and is applied continuously for a long time. If only 15% to 20% of the total maximum muscle strength is used, no muscle complaints will occur, but if muscle contractions are performed by >20%, a decrease in blood circulation will occur. This in turn can cause a decrease in the supply of oxygen sent by the muscles and inhibit the process of carbohydrates, leading to a buildup of lactic acid which causes muscle complaints and even pain (Tjahayuningtyas, 2019). Meanwhile, the causes of musculoskeletal disorders expressed by Tarwaka include unnatural work positions, such as bending the neck (, raising hands, and so on. The farther a person away from the middle of gravity, the greater the hazard of skeletal muscle discomfort. Unusual work positions are usually caused by job requirements, work equipment, and workstation characteristics that do not match the capabilities and limitations of workers (Tjahayuningtyas, 2019).

The age factor also affects the musculoskeletal complaints (Hanif, 2020). Tarwaka (2015) stated that musculoskeletal complaints are mostly felt by those who are at the age of 35-65 years old. The first grievance is normally felt on the age of 35 years and could retain to boom with age (Hanif, 2020). This then causes physical capacity to decrease, which will then be followed by a decrease in VO₂ max or maximum capability that a person has in consuming oxygen when his body is doing intense activities, such as sports. This will eventually decrease work capability, which occurs due to biological changes in middle age muscle strength and endurance begin to decline due to the aging process. With decreased muscle endurance, the potential for musculoskeletal complaints in middle age will increase.

The working period is another determining factor that affects the musculoskeletal complaints. The working period is the time or period of time a employee works in a place. The longer the operating period is, the more musculoskeletal complaints are experienced (Komarliawati, Djojogugito and Nurhayati, 2019). This is because musculoskeletal complaints are chronic diseases and take a long time to develop and cause pain. Therefore, the longer the working period, the higher the musculoskeletal complaints.

Another factor that can affect the onset of musculoskeletal complaints is exercise routines.

Physical activities that are carried out irregularly cause a person to experience musculoskeletal complaints, but if exercise is done regularly it will minimize the risk of muscle complaints and make the body more fit (Helmina *et al.*, 2019). A high level of body fitness will reduce the risk of developing musculoskeletal complaints (Viswanatha and Adiatmika, 2020).

Research conducted by Shobur *et al.* (2019) stated that age affects the musculoskeletal complaints of the weaving staff at Tuan Kentang. Meanwhile, research conducted by Anas *et al.* (2013) found that the working period had a significant effect on musculoskeletal complaints. Meanwhile, research conducted by Djaali and Utami (2019) proved that exercise habits were a significant factor affecting musculoskeletal complaints.

One of the businesses whose employees or workers have the potential to experience musculoskeletal complaints is batik making. Producing a piece of batik cloth with good quality depending on the motifs and patterns produced generally takes up to almost a month. The motifs and patterns produced from batik are obtained from the canting (a small dipper used to apply wax in batik process). The process of canting requires patience, precision, and high attention because the wax used is very hot. The process of canting is carried out by batik craftsmen while sitting on a small chair or dingklik (a stool with no back support and armrest) for a long time (Savitri and Sumekar, 2015). The use of the short chair causes unnatural work posture because the back is bent (Saputro, Mulyono and Puspikawati, 2019). This condition is experienced by the batik craftsmen of Ademos in Bojonegoro Regency as it takes a long time to produce each sheet of cloth of batik in Ademos with a process that can increase the risk of musculoskeletal complaints. Besides, the average age of Ademos batik craftsmen is middle age where the muscle function has decreased, which eventually can cause musculoskeletal complaints. This research aimed to determine the correlation between the length of work and exercise routines with musculoskeletal complaints in batik craftsmen of Ademos, Bojonegoro Regency.

METHODS

This study was a descriptive analytic with a sectional design. This study was conducted on July-August 2020. The total population of the study was

42 batik craftsmen who were selected using a total sampling technique. Through this technique, the entire population was used as the research sample.

The independent variables studied included working period and exercise routines. The working period is the length of time the respondent works from the first time he/she starts working until the research is conducted. The working period in this study was categorized into ≥ 5 years and < 5 years. Exercise routines are all forms of physical activity that involve systematic and planned body movements to improve physical fitness for at least 30 minutes a day and > 5 times / week. The dependent variable used in this study was musculoskeletal complaints. The severity of MSDs complaints was assessed using the Nordic Body Map Questionnaire instrument. The questionnaire used an image of the human frame which had been divided into nine foremost parts, specifically the neck, shoulders, upper back, elbows, lower back, wrists/hands, waist/buttocks, knees, and heels/feet. In addition, a picture of 28 parts of the skeletal muscle groups in each aspect of the right and left skeleton was additionally presented, beginning from the higher limbs, specifically the neck muscle groups, to the muscle groups inside the legs. MSDs complaints were categorized based on the total score, where the score 0-42 was categorized as low, while the score of 43-84 was categorized as high.

Data collection was carried out using a questionnaire sheet, observation and the Nordic Body Map Questionnaire. The research data were analyzed descriptively in the form of frequency distribution tables and cross tabulations. The results were then described in a narrative form. Data were analyzed using a Chi-square test with α of 0.05.

This study has passed through an examination of the Ethic Committee in the Faculty of Dental Medicine of Universitas Airlangga. The registration of the ethical clearance number is 292/HRECC. FODM /VI /2020.

RESULTS

Individual Characteristics

Working period

The working period was categorized into 2 years, < 5 years and ≥ 5 years. The majority of batik craftsmen were workers who had worked less than 5

years, as many as 24 respondents (57.1%), while the number of batik craftsmen who had worked for more than 5 years was 18 respondents (42.9%)

Exercise Routines

The results of exercise routines were categorized into two categories, namely doing exercise regularly and doing exercise rarely. routine exercise is the condition in which the respondent does physical activity for at least 30 minutes a day, and the exercise is done > 5 times / week. The majority of respondents did not have exercise routines, accounting for 22 respondents (52.4%) and the number of people who had exercise routines was 20 respondents (47.6%). This can be caused by the lack of free time that batik craftsmen had. Every day batik craftsmen made batik cloth for a long time and continuously, so most batik craftsmen did not have time to do sports.

Musculoskeletal Complaints

The assessment of musculoskeletal complaints on 42 batik craftsmen of Ademos Bojonegoro was carried out using an with a list of questions on the Nordic Body Map. Musculoskeletal complaints were categorized into low and high. Table 2 shows that the majority of the workers' musculoskeletal complaints were in the low category with 22 respondents (52.4%). Furthermore, 20 respondents (47.6%) experienced high category.

Table 1. Frequency Distribution of Individual Characteristics of Batik Craftsmen of Ademos Bojonegoro 2020

| Individual Characteristics | Frequency (n) | Percentage (%) |
|----------------------------|---------------|----------------|
| Work Period | | |
| <5 years | 24 | 57.1 |
| ≥ 5 years | 18 | 42.9 |
| Exercise Routines | | |
| Rarely | 22 | 52.4 |
| Exercise regularly | 20 | 47.6 |

Table 2. Distribution of Musculoskeletal Complaints of Batik Craftsmen of Ademos Bojonegoro 2020

| Category | Frequency (n) | Percentage (%) |
|--------------|---------------|----------------|
| Low | 22 | 52.4 |
| High | 20 | 47.6 |
| Total | 42 | 100.0 |

The results of the assessment of musculoskeletal complaints using the Nordic Body Map questionnaire were later classified into less pain, moderate pain, pain and severe pain. The outcomes of musculoskeletal complaints among 42 batik craftsmen of Ademos Bojonegoro showed that 11 respondents felt severe pain in their spine, 9 respondents felt severe pain in their right hand and 23 respondents felt pain in their right hand. In addition, 24 respondents felt pain in the left lower arm and right wrist, and 22 respondents felt pain in the right shoulder and buttocks. The results of musculoskeletal complaints are shown in Table 3.

The Correlation between Working Period and Musculoskeletal Complaints experienced by Batik Craftsmen of Ademos Bojonegoro 2020

Based on Table 4, it can be seen that 66.7% of respondents with low musculoskeletal complaints had worked as batik craftsmen of Ademos Bojonegoro for <5 years. Meanwhile, there were 33.3% of respondents who had low musculoskeletal complaints and had worked as batik craftsmen for Ademos Bojonegoro for ≥ 5 years. As many as 33.3% of respondents had high musculoskeletal complaints with a service period of <5 years, while the remaining 66.7% had worked for ≥ 5 years.

Table 3. Location Distribution of Musculoskeletal Complaints on Batik Craftsmen of Ademos Bojonegoro 2020

| Organ | Musculoskeletal Complaints | | | | | | | | Total | |
|-----------------|----------------------------|-------|---------------|-------|------|-------|-------------|-------|-------|--------|
| | Less pain | | Moderate Pain | | Pain | | Severe Pain | | | |
| | n | % | n | % | n | % | n | % | N | % |
| Upper neck | 12 | 28.57 | 18 | 42.85 | 10 | 23.80 | 2 | 4.78 | 42 | 100.00 |
| Lower neck | 7 | 16.67 | 15 | 35.71 | 13 | 30.95 | 7 | 16.67 | 42 | 100.00 |
| Left shoulder | 15 | 35.71 | 15 | 35.71 | 8 | 19.05 | 4 | 9.53 | 42 | 100.00 |
| Right shoulder | 1 | 2.38 | 18 | 42.85 | 22 | 52.30 | 1 | 2.38 | 42 | 100.00 |
| Left upper arm | 4 | 9.53 | 30 | 71.42 | 4 | 9.530 | 4 | 9.53 | 42 | 100.00 |
| Spine | 0 | 0.00 | 16 | 38.09 | 15 | 35.71 | 11 | 26.19 | 42 | 100.00 |
| Right upper arm | 1 | 2.38 | 14 | 33.33 | 19 | 45.24 | 8 | 19.05 | 42 | 100.00 |
| Waist | 2 | 4.78 | 20 | 47.62 | 15 | 35.71 | 5 | 11.90 | 42 | 100.00 |
| Buttock | 9 | 21.43 | 9 | 21.43 | 22 | 52.30 | 2 | 4.78 | 42 | 100.00 |
| Buttom | 18 | 42.86 | 17 | 40.48 | 7 | 16.67 | 0 | 0.00 | 42 | 100.00 |
| Left elbow | 13 | 30.95 | 22 | 52.38 | 7 | 16.67 | 0 | 0.00 | 42 | 100.00 |
| Right elbow | 6 | 14.29 | 19 | 45.24 | 16 | 38.09 | 1 | 2.38 | 42 | 100.00 |
| Left lower arm | 9 | 21.43 | 8 | 19.05 | 24 | 57.14 | 1 | 2.38 | 42 | 100.00 |
| Right lower arm | 4 | 9.53 | 11 | 26.19 | 19 | 45.24 | 8 | 19.05 | 42 | 100.00 |
| Left wrist | 2 | 4.78 | 16 | 38.09 | 20 | 47.62 | 4 | 9.53 | 42 | 100.00 |
| Right wrist | 2 | 4.78 | 8 | 19.05 | 24 | 57.14 | 8 | 19.05 | 42 | 100.00 |
| Left hand | 5 | 11.9 | 14 | 33.33 | 15 | 35.71 | 8 | 19.05 | 42 | 100.00 |
| Right hand | 4 | 9.53 | 6 | 14.29 | 23 | 54.76 | 9 | 21.43 | 42 | 100.00 |
| Left thigh | 15 | 35.71 | 19 | 45.24 | 8 | 19.05 | 0 | 0.00 | 42 | 100.00 |
| Right thigh | 16 | 38.09 | 18 | 42.86 | 8 | 19.05 | 0 | 0.00 | 42 | 100.00 |
| Left knee | 11 | 26.19 | 16 | 38.09 | 13 | 30.95 | 2 | 4.78 | 42 | 100.00 |
| Right knee | 10 | 23.80 | 14 | 33.33 | 14 | 33.33 | 4 | 9.53 | 42 | 100.00 |
| Left calf | 9 | 21.43 | 16 | 38.09 | 16 | 38.09 | 1 | 2.38 | 42 | 100.00 |
| Right calf | 9 | 21.43 | 15 | 35.71 | 17 | 40.48 | 1 | 2.38 | 42 | 100.00 |
| Left ankle | 3 | 7.14 | 21 | 50.00 | 15 | 35.71 | 3 | 7.14 | 42 | 100.00 |
| Right ankle | 3 | 7.14 | 19 | 45.24 | 17 | 40.48 | 3 | 7.14 | 42 | 100.00 |
| Left leg | 5 | 11.90 | 27 | 64.29 | 8 | 19.05 | 2 | 4.78 | 42 | 100.00 |
| Right leg | 6 | 14.29 | 25 | 59.52 | 8 | 19.05 | 3 | 7.14 | 42 | 100.00 |

The results of the Chi-square test analysis was $\text{sig}=0.032$ ($\alpha=0.05$), which means that there was a significant correlation between working period and musculoskeletal complaints among batik craftsmen of Ademos Bojonegoro. On the other hand, coeff (Phi Correlation) was 0.330. This indicates that there was a quite significant correlation and positive correlation direction between working period and musculoskeletal complaints experienced by batik craftsmen of Ademos Bojonegoro. The longer the painting period, the higher the level of musculoskeletal complaints.

The Correlation between Exercise Routines and Musculoskeletal Complaints Experienced by Batik Craftsmen of Ademos Bojonegoro 2020

Based on Table 4, it was found that in the category of low musculoskeletal complaints, 59.1% of respondents did not have exercise routines, while the remaining 45.0% did exercise routines. Moreover, in the high category 40.9% of respondents did not do exercise routines, and the number of respondents who did exercise routines was as many as 55.0%.

The outcomes of the Chi-square test was $\text{sig}=0.361$ ($\alpha=0.05$), so there was no correlation between exercise routines and musculoskeletal complaints among batik craftsmen of Ademos Bojonegoro. On the other hand, coeff (Phi Correlation) was 0.141. This indicates that the correlation between exercise routines and musculoskeletal experienced by batik craftsmen of Ademos Bojonegoro was weak.

DISCUSSION

Individual Characteristics

Working Period

The working period is the length of time a person works or the length of time for an employee works so that he has a sense of responsibility, a sense of belonging, courage, and self-awareness towards the company, which will affect labor productivity (Karima, Idayanti and Umar, 2018). Someone with a longer working period shows more experience than other colleagues. Meanwhile, the operating length is one of the elements that have a correlation with muscle complaints. The longer a person has to work, the more he is at risk of developing MSDs.

Based on the research conducted, the working period <5 years predominated. MSDs can also arise as a result of inadequate facilities such as the respondents having to work with a short chair or a chair whose height cannot be adjusted and not being in a relaxed position. This result is in line with research of Tjahayuningtyas (2019) which stated that the work which is repeated and takes place every day makes workers use quite a lot of energy to complete the job. If this activity lasts for years, it will increase the perceived hazard of musculoskeletal disorders in workers.

Exercise Routines

The majority of respondents did not exercise regularly because of the lack of free time that the

Table 4. The Correlation between Working Period and Exercise Routines with Musculoskeletal Complaints on Batik Craftsmen of Ademos Bojonegoro 2020

| | Musculoskeletal Complaints | | | | | | Sig. | Coeff. |
|--------------------------|----------------------------|-------|------|-------|-------|-------|-------|--------|
| | Low | | High | | Total | | | |
| | n | % | n | % | N | % | | |
| Working period | | | | | | | | |
| <5 years | 16 | 66.6% | 8 | 33.3% | 24 | 57.1% | 0.032 | 0.330 |
| ≥ 5 years | 6 | 33.3% | 12 | 66.7% | 18 | 42.9% | | |
| Exercise Routines | | | | | | | | |
| No exercise routines | 13 | 59.1% | 9 | 40.9% | 22 | 52.4% | 0.361 | 0.141 |
| Exercise routines | 9 | 45.0% | 11 | 55.0% | 20 | 47.6% | | |

batik craftsmen had. Every day batik craftsmen made batik cloth for a long time and continuously, so that most of the batik craftsmen did not have time to do exercise, while only a few respondents who did sports, such as jogging, gymnastics and cycling. Research conducted by Helmina *et al.* (2019) asserted that workers who were dominated by women considered that regular exercise was a waste of time because they thought that the activities at work coupled with household routines were heavy enough to carry out physical movements, so they thought they did not need to exercise anymore. If female workers had free time, they would use it to take a rest.

In line with this issue, the more often a person does physical activity, namely exercising, the more fit his body will be. When the body's fitness level is high, it will reduce the risk of muscle injury. This is also in line with the habits of the Indonesian population who are lazy to do sports for reasons such as being tired, having no time, and even feeling lazy (Tjahayuningtyas, 2019)

Musculoskeletal Complaints

Based on the respondent's information, the body parts that were felt to be experiencing severe pain were the back, right hand, right wrist, right elbow, right shoulder and buttocks. This is due to the stiff and static work posture when making batik for a long time and the repetitive movements of the right upper body, which makes it incompatible with the anthropometric conditions of the workers. Batik craftsmen also experienced static posture on the lower body, especially on the buttocks because they sat on the small chair for too long. This is in accordance with a study conducted by Prabarukmi and Widajati which stated that there was a strong correlation between ergonomic risk factors and musculoskeletal complaints due to stiff work posture when making batik. These musculoskeletal complaints arise due to various factors, namely excessive muscle contraction, and unnatural repetitive activities during working (Helmina, Diani and Hafifah, 2019).

The Correlation between Working Period and Musculoskeletal Complaints experienced by Batik Craftsmen of Ademos Bojonegoro

The results of the study confirmed that there was a quite significant correlation between working period and musculoskeletal complaints experienced

by batik craftsmen of Ademos Bojonegoro. The longer the working period, the higher the musculoskeletal complaints. This is because the longer the working period a worker has, the longer he is affected by the conditions of the workplace and the way of working. Batik craftsmen of Ademos Bojonegoro who spend most of their working time sitting in a short chair for a long time to make batik will be affected by the work process, causing physical complaints, one of which is musculoskeletal complaints. The result of this study is in line with research of Komarliawati *et al.* (2019) which showed the impact of operating length on musculoskeletal disorders. The longer the working period, the more musculoskeletal complaints experienced because musculoskeletal complaints are chronic diseases, which take a long time to develop and cause pain. Therefore, the longer the working period, the higher the musculoskeletal complaints.

The Correlation between Exercise Routines and Musculoskeletal Complaints on Batik Craftsmen of Ademos Bojonegoro

The results of this study showed that there was a correlation between routine exercises and musculoskeletal disorders among batik craftsman Ademos Bojonegoro, although it was very weak. This result is not in accordance with several previous studies which found a correlation between exercise routines and musculoskeletal complaints. The more often someone exercises, the fewer musculoskeletal complaints he has, but on the other hand, the less someone does exercises, the more musculoskeletal complaints he has. The result of this study is in accordance with the research result of Viswanatha and Adiatmika (2020) stating that exercise routines affected musculoskeletal disorders. This is because if someone exercises regularly, it will minimize the risk of muscle complaints and make the body more fit (Helmina, Diani and Hafifah, 2019). A high level of body fitness will reduce the risk of developing musculoskeletal complaints (Viswanatha and Adiatmika, 2020).

Batik craftsmen of Ademos Bojonegoro admitted that they did not have time to do regular exercise considering that batik activity requires a lot of time and long concentration for a day. Therefore, they prioritized doing housework and resting when returning home after work.

Based on recommendations by Tarwaka (2015), ergonomic measures, namely engineering techniques (such as station design and work equipment) and

management (such as work organization) are needed to prevent diseases. An ergonomic workstation design is very important to achieve higher work productivity. Improvements that can be made to reduce the risk of Musculoskeletal Disorders (MSDs) among batik craftsmen of Ademos Bojonegoro include technical techniques by arranging workstation repairs, such as designing a stove height to suit the worker's bench height. These improvements are important so that the reach of the hand position when the craftsmen are taking the candle is not too far away so that the body does not bend too much. Wooden chairs in the shape of a box (dingklik), which previously had a height lower than the knee, should also be replaced with wooden chairs that are knee-high, have a back and arms and are given foam on their surface adjusted to the anthropometry of the workers. It is also recommended that the stove be placed in front of the user at a distance that allows the elbow to remain close to the user's body so that the craftsmen's arms are relaxed and parallel to the floor.

Administrative control can be done by making the work duration normal and limiting overtime to a maximum of three hours and not doing it every day. Stretching the shoulder arm muscles every 4 hours while working or during rest hours is also very necessary so that the muscles are not tense. Apart from stretching, making SOPs (Standard Operating Procedures) on healthy work methods for craftsmen and creating a rotation system so that craftsmen do not do monotonous work are also some other measures suggested as administrative control. According to Ademos Bojonegoro, batik craftsmen can be advised to do stretching exercises with movements carried out three instances in line with repetition with a period of time in line with set, particularly 6 to 7 minutes (Prabarukmi and Widajati, 2020).

CONCLUSION

Based on the findings obtained, it can be concluded that high musculoskeletal complaints were also mostly felt during the working period of > 5 years because the longer a worker works, the longer he is affected by the conditions of the workplace and the way he works. In this study, there was a quite significant correlation between working period and musculoskeletal complaints experienced by batik craftsmen of Ademos Bojonegoro. Batik Ademos takes a long time to produce each sheet of

cloth through several processes. This then increases the risk of musculoskeletal complaints experienced by the craftsmen. This condition is exacerbated by the absence of time for the batik craftsmen to do exercises.

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